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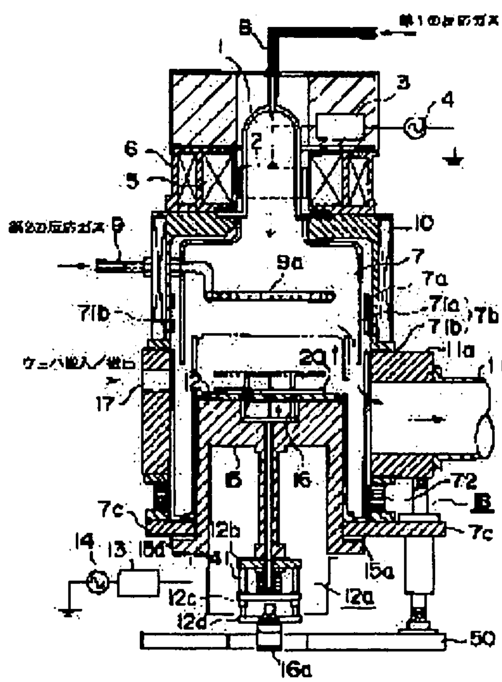
(54) SUBSTRATE RETAINER AND FILM FORMING/ETCHING DEVICE

(57)Abstract:

PURPOSE: To provide a film forming/etching device such that the power consumption for heating a substrate is reduced, the temperature of the substrate is changed in a short period, the lowering of through-put is prevented, and the maintenance manhours and cost of production can be decreased, in which the substrate is heated up and an insulating film is formed using reaction gas.

CONSTITUTION: An electrode, with which the substrate to be treated by applying a voltage, is electrostatically attracted into a treatment chamber 7 which is partitioned from outside part by a chamber 7a where the substrate 20 is treated by treatment gas, and a substrate retainer 12, which is formed on a common substrate together with a heating means which heats the substrate, is provided.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The substrate holder characterized by coming to form the electrode which attracts the substrate which should impress and process an electrical potential difference electrostatic, and a heating means to heat said held substrate in a common base.
[Claim 2] The membrane formation/etching system which equipped with the substrate holder according to claim 1 the processing interior of a room which was divided with the exterior by the chamber, and which processes said substrate with raw gas.
[Claim 3] Said processing room is the membrane formation/etching system according to claim 2 characterized by having the protection wall which intervenes between said chambers and said substrate holders, and protects the wall of said chamber from adhesion of a resultant.
[Claim 4] Said protection wall is the membrane formation/etching system according to claim 3 characterized by being dismountable.
[Claim 5] They are the membrane formation/etching system according to claim 3 or 4 which said protection wall is divided into an up protection wall and a lower protection wall, and is characterized by it being possible to make it move up and down in the condition of having lapped mutually, respectively as for said up protection wall and said lower protection wall.
[Claim 6] Claim 3 characterized by forming irregularity in the front face of said protection wall, membrane formation/etching system according to claim 4 or 5.
[Claim 7] Claim 2 characterized by having the vertical migration means which pulls down said chamber to which moved said chamber up and it was made to move up in the original location, claim 3, claim 4, membrane formation/etching system according to claim 5 or 6.
[Claim 8] They are the membrane formation/etching system which has the processing room which processes a substrate with raw gas, and a substrate holder holding said substrate which should be processed, and is characterized by having the protection wall which said processing room intervenes between the chamber into which the exterior and said processing interior of a room are divided, and said chamber and said substrate holder, and protects the wall of said chamber from adhesion of a resultant.
[Claim 9] Said protection wall is the membrane formation/etching system according to claim 8 characterized by being dismountable.
[Claim 10] They are the membrane formation/etching system according to claim 8 or 9 which said protection wall is divided into an up protection wall and a lower protection wall, and is characterized by it being possible to make it move up and down in the condition of having lapped mutually, respectively as for said up protection wall and said lower protection wall.
[Claim 11] Claim 8 characterized by forming irregularity in the front face of said protection wall, membrane formation/etching system according to claim 9 or 10.
[Claim 12] Claim 8 characterized by having the vertical migration means which pulls down said chamber to which moved said chamber up and it was made to move up in the original location, claim 9, membrane formation/etching system according to claim 10 or 11.
[Claim 13] The support shaft with which the gear tooth with which said vertical migration means goes

around a shaft around spirally is formed, and supports said chamber, claim 7 characterized by having the driving means which rotates the gear tooth of said support shaft, the support base which is seen and supports said support shaft, and said support shaft with the gear tooth which was formed in the wall of the hole in which said support shaft is inserted, and which goes around spirally -- again -- membrane formation/etching system according to claim 12.
[Claim 14] Said substrate holder is claim 2 characterized by being prepared on the electrode which impresses the alternating current electrical signal which activates said raw gas or carries out bias of said held substrate, claim 3, claim 4, claim 5, claim 6, claim 7, claim 8, claim 9, claim 10, claim 11, and membrane formation/etching system according to claim 12 or 13.
[Claim 15] Said membrane formation/etching system are claim 2 characterized by being the CVD system which uses the plasma in the Helicon mode, claim 3, claim 4, claim 5, claim 6, claim 7, claim 8, claim 9, claim 10, claim 11, claim 12, and membrane formation/etching system according to claim 13 or 14.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the substrate holder holding the membrane formation / etching system which carries out substrate heating, and forms an insulator layer etc. using reactant gas, or etches, and the substrate which should be processed, if it says in more detail about a substrate holder, and membrane formation/etching system.
[0002]
[Description of the Prior Art] It sets to manufacture of a semiconductor device and a CVD system is SiO2 film and PSG. The film and BSG The film, the BPSG film, and Si3N4 The film, the amorphous Si film, the polycrystal Si film, W film, Mo film, WSi2 film, and MoSi2 When forming the film, aluminum film, etc., it is useful membrane formation equipment. When the CVD system of the conventional example is classified according to a means to activate reactant gas, there is mainly ** heat CVD system ** photon assisted CVD system ** plasma-CVD equipment.
[0003] By heating reactant gas, the heat CVD system has a heating means to give heat energy to reactant gas and to activate reactant gas, and is classified into low voltage and ordinary pressure according to the pressure to be used. Moreover, it is classified into low temperature and an elevated temperature according to substrate temperature, and is further classified into resistance heating, induction heating, and lamp heating according to a heating means. Moreover, it is classified into a hot wall mold and a cold wall mold according to the installation of a heating means.
[0004] Moreover, by irradiating ultraviolet rays at reactant gas, the photon assisted CVD system has the Mitsuteru gunner stage which gives energy to reactant gas and activates reactant gas, and film formation is possible for it under low voltage or high voltage and at low temperature. Furthermore, a plasma production means to activate reactant gas directly or indirectly using alternating current power or a magnetic field is used for plasma-CVD equipment, and, generally it is performed at low voltage and low temperature. Energy is given to an electron by the parallel plate mold, the high-frequency power, and the magnetic field which activate reactant gas directly by radiation of high-frequency power, and it is classified into the ECR mold which activates reactant gas indirectly with this electron according to a plasma production means.
[0005] Moreover, an etching system, especially a dry etching system are SiO2 film and PSG. The film, the BSG film, the BPSG film, and Si3N4 When etching the film, the amorphous Si film, the polycrystal Si film, W film, Mo film, WSi2 film, MoSi2 film, aluminum film, etc. with a sufficient precision, it is the manufacturing installation of a useful semiconductor device, and it is classified almost like the above-mentioned CVD system. In the above-mentioned CVD system and the etching system, the mechanical chuck, the vacuum chuck, or the electrostatic chuck is prepared in the substrate holder which fixes the substrate which should be processed.
[0006] Moreover, in the manufacturing installation of the above-mentioned semiconductor device, since only the substrate periphery is heating especially the cold wall mold, a reaction occurs by the substrate periphery and there is an advantage that a resultant cannot adhere to the wall of a reaction chamber

easily. The heating means is established through RF electrode etc. under the substrate holder.
[0007]
[Problem(s) to be Solved by the Invention] However, since the substrate on a substrate holder is heated through RF electrode etc. in the case of a cold wall mold, there is an advantage that the substrate temperature once held for the heat capacity of RF electrode etc. cannot be changed easily, but large power is consumed in order to heat a substrate. Moreover, when substrate temperature wants to change, it cannot respond in a short time, but long duration is taken to stabilize substrate temperature to the temperature which should be changed.
[0008] Furthermore, in the above-mentioned membrane formation equipment and an etching system, since a resultant arises to some extent, it adheres to the wall of a reaction chamber and becomes causes of generating, such as particle. Therefore, although it is necessary to remove these resultants periodically therefore, a throughput falls and great time and effort and cost start. It aims at offering the substrate holder holding membrane formation / [which lowering of a throughput is prevented and can reduce the time and effort and cost for maintenance] etching system, and the substrate that should be processed while this invention is created in view of the technical problem of the starting conventional example, and cuts down the power consumption for substrate heating and can change substrate temperature in a short time.
[0009]
[Means for Solving the Problem] The electrode which attracts the substrate which the above-mentioned technical problem should impress [1st] an electrical potential difference, and should be processed electrostatic, It is attained by the substrate holder characterized by coming to form a heating means to heat said held substrate in a common base. It is attained by the membrane formation/etching system which equipped with the substrate holder given in the 1st invention the processing interior of a room which was divided [2nd] with the exterior by the chamber, and which processes said substrate with raw gas. Said processing room is attained by membrane formation/etching system given in the 2nd invention characterized by having the protection.wall which intervenes between said chambers and said substrate holders, and protects the wall of said chamber from adhesion of a resultant the 3rd. It is attained by membrane formation/etching system given in the 3rd invention characterized by said protection wall being dismountable the 4th. Said protection wall is divided into an up protection wall and a lower protection wall by the 5th, and it is attained by membrane formation/etching system given in the 3rd or 4th invention characterized by it being possible to make it move up and down in the condition of having lapped mutually, respectively as for said up protection wall and said lower protection wall. To the 6th It is attained by membrane formation/etching system given in the 3rd, 4th, or 5th invention characterized by forming irregularity in the front face of said protection wall. It is attained by membrane formation/etching system given in the 2nd, 3rd, 4th, 5th, or 6th invention characterized by having the vertical migration means which pulls down said chamber which was made to move said chamber to the 7th up, and was moved to it up in the original location. To the 8th It has the processing room which processes a substrate with raw gas, and a substrate holder holding said substrate which should be processed. Said processing room It is attained by the membrane formation/etching system characterized by having the protection wall which intervenes between the chamber into which the exterior and said processing interior of a room are divided, and said chamber and said substrate holder, and protects the wall of said chamber from adhesion of a resultant. It is attained by membrane formation/etching system given in the 8th invention characterized by said protection wall being dismountable the 9th. Said protection wall is divided into an up protection wall and a lower protection wall by the 10th, and it is attained by membrane formation/etching system given in the 8th or 9th invention characterized by it being possible to make it move up and down in the condition of having lapped mutually, respectively as for said up protection wall and said lower protection wall. It is attained by membrane formation/etching system given in the 8th, 9th, or 10th invention characterized by forming irregularity in the front face of said protection wall the 11th. It is attained by membrane formation/etching system given in the 8th, 9th, 10th, or 11th invention characterized by having the vertical migration means which pulls down said chamber which was made to move said chamber to the 12th up, and was moved to it up in the original

location. To the 13th said vertical migration means The support shaft which the gear tooth which goes around a shaft around spirally is formed, and supports said outside chamber or said chamber, The support base which is blown with the gear tooth of said support shaft by the gear tooth which was formed in the wall of the hole in which said support shaft is inserted, and which goes around spirally, and supports said support shaft, It is attained by membrane formation/etching system given in the 7th or 12th invention characterized by having the driving means which rotates said support shaft. To the 14th said substrate holder Said raw gas is activated. It is attained by membrane formation/etching system given in the 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th, or 13th invention characterized by being prepared on the electrode which impresses the alternating current electrical signal which carries out bias of said held substrate. Or to the 15th Said membrane formation/etching system are attained by membrane formation/etching system given in the 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, or 14th invention characterized by being the CVD system which uses the plasma in the Helicon mode.

[0010]

[work --] for The electrode and heating means of an electrostatic chuck are formed in the common base in the substrate holder concerning this invention. Therefore, it is only that the base of a substrate holder or the electrode of an electrostatic chuck intervenes between the substrates and heating means which were held. Since the heat capacity of the base of a substrate holder or the electrode of an electrostatic chuck is small, it can cut down the power consumption for substrate heating, and can change substrate temperature in a short time, and can be stabilized.

[0011] Moreover, since a substrate is fixed and the electrostatic chuck is used, even when it is under reduced pressure and performs substrate processing unlike a vacuum chuck, it can use. Furthermore, by the mechanical chuck, in case it is a pawl-like thing and a substrate is fixed, a substrate is damaged, or the remains of maintenance remain in a substrate front face, but since the electrostatic chuck is used, these can be prevented. Moreover, as compared with a mechanical chuck, attachment and detachment of a substrate are easy.

[0012] According to the membrane formation/the etching system concerning this invention, since it has the above-mentioned substrate holder, it can be under reduced pressure, substrate processing can be performed, and attachment and detachment of a substrate are easy. Moreover, power-saving and improvement in a throughput can be aimed at. Moreover, the processing room has a chamber and dual structure of a protection wall, it dissociates with a chamber and a protection wall can be removed. As occasion demands, it can exchange.

[0013] Therefore, when a resultant adheres to the wall of a protection wall, after returning the processing interior of a room to an atmospheric pressure, migration etc. makes a chamber the upper part with vertical migration means, such as a lift, and a protection wall is taken out. The taken-out protection wall removes the resultant which washed and adhered to the wall of a protection wall. Furthermore, processing can be continued during washing of a previous protection wall by setting another protection wall instead of the taken-out protection wall in the processing interior of a room.

[0014] Moreover, by forming irregularity in the front face of a protection wall, the touch area of the resultant to a protection wall can be enlarged, bond strength can be raised, and it can prevent that the resultant which adheres to a protection wall before exchange exfoliates. Furthermore, suitable spacing can be held between the gas installation implements and substrates which were made to go up and down a substrate holder, and were installed in the substrate upper part by making it possible to separate into an up protection wall and a lower protection wall, and to move a protection wall up and down, respectively.

[0015] By this, equipment cannot be stopped over a long time for defecation of the processing indoor section, and improvement in a throughput can be aimed at, and the time and effort and cost for maintenance can be reduced.

[0016]

[Example] Next, the example of this invention is explained, referring to a drawing.

(1) The explanatory view 1 about the CVD system concerning the example of explanation (A) this

invention about the membrane formation/etching system concerning the example of this invention is a side elevation showing the configuration of the whole CVD system concerning the example of this invention. In this example, it illustrates about the CVD system which uses the plasma in the Helicon mode.

[0017] It is the 1st reactant gas 2 which is plasma production room where 1 consists of a quartz of the shape of a cylinder with a diameter [of 15cm] x die length of 25cm in drawing 1 , and was introduced from the 1st reactant gas installation tubing 8, for example, Ar+O. Gas is activated. And the 1st reactant gas installation tubing 8 is connected to the upper part of the plasma production room 1. In addition, the 1st reactant gas installation tubing 8 may be arranged, and reactant gas may be introduced in the plasma production room 1 so that the gas port of the 1st reactant gas installation tubing 8 may come to the ~~center section of the plasma~~ production room 1.

[0018] 2 is the external antenna attached in the perimeter of the plasma production room 1. Two cyclic lead wire sets predetermined spacing, and is going the upper part of the cylinder-like plasma production room 1, and a lower periphery around. Spacing of two cyclic lead wire is important in order to adjust, the wave number, i.e., the plasma consistency, of a helicon wave. An example of the configuration of this external antenna 2 is shown in drawing 2 . In this case, RF current flows to two cyclic lead wire, and the helicon wave in zero mode is formed towards reverse at them, respectively. In addition, formation of the helicon wave of the higher mode is also possible by changing the configuration of an external antenna.

[0019] The matching network where 3 was connected to the external antenna 2, and 4 are RF power sources which supply RF power with a frequency of 13.56MHz to the external antenna 2 through a matching network 3. RF power serves as an energy source of plasma production. The cylinder-like inside source solenoid by which 5 was prepared in the perimeter of the plasma production room 1, and 6 are the outside source solenoids of the shape of a cylinder prepared in the perimeter of the inside source solenoid 5, and the inside source solenoid 5 and the outside source solenoid 6 form a magnetic field in the plasma production room 1 at shaft orientations. Such a magnetic field is needed in order to form a helicon wave and to adjust a plasma consistency.

[0020] Although the above is the equipment configuration of the plasma production room 1 required for the plasma production of the high density (3 or more [1012cm -]) in the Helicon mode, and its periphery, spacing of two cyclic lead wire of RF power, a magnetic field, and the above-mentioned external antenna 2 serves as a parameter important for plasma production especially. 7 is the membrane formation room (processing room) divided by chamber 7a of the shape of a cylinder with a bore [it is connected / lower stream of a river / of the plasma production room 1 / bore / of 30cm] x die length of 22.5cm, the elastic bellows 72, and seal section 7c with the exterior.

[0021] While the plasma in the Helicon mode which consists of the 1st reactant gas which occurred at the plasma production room 1 is supplied in the membrane formation room 7, the 2nd reactant gas, for example, SiH4 gas, is introduced in the membrane formation room 7 from the 2nd reactant gas installation tubing 9. The 2nd reactant gas installation tubing 9 has gas-evolution section 9a which consists of a quartz pipe of the shape of a ring with a diameter of about 20cm, and two or more gas-evolution holes which emit reactant gas on a wafer 20 are formed in the quartz pipe. On the wafer 20, the 2nd reactant gas installation tubing 9 keeps a predetermined distance, and is arranged.

[0022] Moreover, the membrane formation room 7 has dual structure of chamber 7a and protection wall 7b. A detailed configuration is explained below. 10 is the chamber solenoid which consists of a permanent magnet of the shape of a cylinder prepared in the perimeter of the membrane formation room 7, and a suitable magnetic field can impress it now to the membrane formation room 7. Thereby, the plasma is led to the membrane formation room 7 from the plasma production room 1, and the configuration of the plasma of flowing is adjusted.

[0023] 11 is an exhaust port where an exhauster is connected, in order to decompress the plasma production room 1 and the membrane formation room 7, and is prepared in the membrane formation room 7 while it discharges unnecessary reactant gas. 12 is the wafer holder (substrate holder) which lays the wafer 20 prepared in the lower part of the membrane formation room 7, and is built in the insulating

base with common electrostatic chuck which impresses an electrical potential difference and fixes a wafer 20 electrostatic and heater which heats a wafer 20. Moreover, it moves up and down by vertical migration device 12a. The detailed configuration of the wafer holder 12 is explained below.

[0024] Next, it explains, referring to drawing 4 about vertical migration device section 12a of the wafer holder 12. In drawing 4 , 41 is the ball screw which supports support plate 12b through bearing support 42, and the gear tooth which goes around a shaft around spirally is formed in the ball screw 41. Moreover, 43 is the ball nut prepared in stationary-plate 12c, is blown with the gear tooth of a ball screw 41 by the gear tooth which was formed in the wall of the hole in which a ball screw 41 is inserted and which goes around spirally, and supports a ball screw 41. A ball screw 41 fluctuates by rotating a ball screw 41.

[0025] 44 is a stepping motor of five phases connected to a ball screw 41 through the helical coupling 45. The helical coupling 45 tells the turning effort of a stepping motor 44 to a ball screw 41 by two helical gears. A ball screw 41 is rotated with a stepping motor 44, and vertical migration of the wafer holder 12 is carried out through support plate 12b and the RF electrode 15. The bellows 72 prepared between chamber 7a and seal section 7c expands and contracts, and, as for the inside of the membrane formation room 7, a reduced pressure condition is held at this time.

[0026] The RF power source 14 which 15 is RF electrode prepared in the lower part of the wafer holder 12 in contact with the wafer holder 12, and supplies the power of the frequency of 13.56MHz or 100 kHz is connected through the matching network 13. By impressing the power of the frequency of 13.56MHz, or 100 kHz to a wafer 20, negative auto-bias direct current voltage is impressed to a wafer 20, and membraneous qualities, such as a consistency of the film formed and stress, are optimized.

[0027] 16 is a wafer lift pin, it moves through the breakthrough of the RF electrode 13 and the wafer holder 12 by vertical migration means 16a, pushes up a wafer 20, and pulls apart a wafer 20 from the installation side of the wafer holder 12. And the pulled-apart wafer 20 is held by a non-illustrated wafer conveyance implement etc., and is picked out from wafer carrying-in / taking-out opening 17.

[0028] 18 is a chamber lift (vertical migration means) which pulls down chamber 7a which supported flange 11a of an exhaust port 11, was made to move chamber 7a of the membrane formation room 7 up through flange 11a, and moved up in the original location. In addition, on a drawing, although only one side is indicated, the chamber lift 18 is formed also in others and a side in order to usually support chamber 7a with sufficient balance. A detailed configuration is explained below.

[0029] 50 is the floor in which the chamber lift 18 and the CVD system were installed. Since it has the heater and the wafer holder 12 which contains an electrostatic chuck according to the CVD system concerning the example of this invention, it can be under reduced pressure, membranes can be formed on a wafer 20, and attachment and detachment of a wafer 20 are easy. Moreover, power-saving and improvement in a throughput can be aimed at.

[0030] (B) The explanatory view 3 about the detail of the wafer holder concerning the example of this invention (a) is drawing showing the detail of the wafer holder 12 concerning the example of this invention. The upper drawing is an A-A line sectional view in a lower top view. In drawing 3 (a), the base with which 21 consists of a disc-like alumina ceramic or SiC, and 22 are the electrodes for electrostatic chucks embedded in the shape of a field in the management of a base 21, and can use a tungsten (W), molybdenum (Mo), or platinum (Pt) as an ingredient of an electrode 22. In order that the beer hall established in the base 21 in order that the heater coil (heating means) which 23 was electrically divided into the bottom of an electrode 22 with the electrode 22, and was embedded at the base 21, and 24 might take out the lead 25 connected to the electrode 22 from the lower part of the wafer holder 12, and 26a and 26b may take out the leads 27a and 27b connected to the heater coil 23 from the lower part of the wafer holder 12, it is the beer hall established in the base 21.

[0031] The configuration of the electrode 22 of an electrostatic chuck has the unipolar type which consists of one electrode, and the bipolar type which consists of two electrodes separated mutually as shown in drawing 3 (b), as shown in drawing 3 (a). In drawing 3 (b), the upper drawing is a B-B line sectional view in a lower top view. What is shown with the same sign as drawing 3 (a) shows the same thing as drawing 3 (a) among drawing, and the other signs 24a and 24b are the beer halls established in

the base 21, in order to take out the leads 25a and 25b connected to the electrodes 22a and 22b of an electrostatic chuck, respectively from the lower part of the wafer holder 12.

[0032] Next, actuation of the electrostatic chuck and heater which have the electrode of the unipolar type shown in drawing 3 (a) is explained. First, the wafer 20 which should form membranes is put on the installation side of the wafer holder 12. Then, vertical migration device section 12a is operated, the RF electrode 15 is moved upwards, and between the wafer holder 12 and gas-evolution section 9a of the 2nd reactant gas installation tubing 9 is held at suitable spacing.

[0033] Then, direct-current-voltage 750V are impressed to the electrode 22 of an electrostatic chuck through lead 25. Thereby, since positive charge is supplied to the electrode 22 of an electrostatic chuck, induction of the negative charge is carried out to a wafer 20 by electrostatic induction. Consequently, a wafer 20 is attracted and fixed to an electrode 22 by Coulomb attraction. Moreover, the alternating current power whose voltage component is about 220V is impressed to the heater coil 23 through Leads 27a and 27b. By supply of the power, the heater coil 23 generates heat, the inside of a base 21 is conducted by heat conduction, and a wafer 20 is heated.

[0034] For example, about 2 hours is taken to carry out temperature up and to be stabilized from a room temperature to the temperature of 450 degrees C, and about 1 hour is taken to lower the temperature from 450 degrees C to a room temperature. As compared with the former, a heating up time is shortened substantially. Membrane formation will be started if temperature is stabilized. Then, in completing membrane formation and taking out a wafer 20, after the electric power supply to the heater coil 23 leaves as it is, stops impression of the electrical potential difference to an electrostatic chuck and cancels electrostatic adsorption, it makes a wafer 20 the upper part by the wafer lift pin 16. Thereby, since a wafer 20 is pulled apart from the wafer holder 12, it holds a wafer 20 with a wafer conveyance implement etc., and takes it out from wafer carrying-in / taking-out opening 17. As occasion demands, the electric power supply to the heater coil 23 may be stopped.

[0035] As mentioned above, in the wafer holder concerning the example of this invention, since the electrode 22 and the heater coil 23 of an electrostatic chuck are embedded in the insulator, it is only that a wafer 20 and the heater coil 23 mind the ceramic of the wafer holder 12, or the electrode 22 for electrostatic chucks. Since the heat capacity of the electrode 22 for a ceramic or electrostatic chucks is small, it can cut down the power consumption for heating of a wafer 20, and can change the temperature of a wafer 20 in a short time, and can be stabilized.

[0036] Moreover, since the electrostatic chuck is used, even when it is under reduced pressure and forms membranes on a wafer 20 unlike a vacuum chuck, it can use. Furthermore, by the mechanical chuck, in case it is a pawl-like thing and a wafer is fixed, a wafer is damaged, or the remains of maintenance remain in a wafer front face, but since the electrostatic chuck is used, these can be prevented. Moreover, as compared with a mechanical chuck, attachment and detachment of a wafer 20 are easy.

[0037] (C) In the explanatory view 1 about the detail of the membrane formation room concerning the example of this invention, the membrane formation room 7 is divided with the exterior by chamber 7a which consists of metals, such as a quartz or aluminum, and it is possible to decompress the inside of the membrane formation room 7. That is, the RF electrode 15 which lays the wafer holder 12 is formed in the lower part of the membrane formation room 7, and the membrane formation room 7 is sealed by joining seal section 7c formed in the lower part of the RF electrode 15, seal section 15a of the shape of a hook formed in one, and chamber 7a through an insulating material. Furthermore, the elastic bellows 72 is formed between chamber 7a and seal section 7c. Thereby, bellows 72 can expand and contract, and even when the wafer holder 12 is made to go up and down, the inside of the membrane formation room 7 can be held in the reduced pressure condition.

[0038] Moreover, tubed protection wall 7b is prepared in accordance with the wall of chamber 7a. The upper part of a cylinder was open for free passage in the plasma production room 1, and the lower part of a cylinder appears in seal section 7c of chamber 7a. Although a quartz is used as an ingredient of protection wall 7b, when using etching gas as reactant gas, the alumina excellent in etching-proof nature can be used. Furthermore, it dissociates with chamber 7a and protection wall 7b can be removed. When required, it can replace with a new protection wall. Moreover, it separates into up protection wall 71a

and lower protection wall 71b, and protection wall 7b is formed with the quartz of a different diameter etc. For example, the outer diameter of up protection wall 71a is smaller than the bore of lower protection wall 71b, and where the wafer holder 12 is lowered to max, the part which overlaps slightly arises, and it is set so that the duplication part of a parenthesis may lap. Thereby, in case vertical migration of the wafer holder 12 is carried out with the RF electrode 15, vertical migration is carried out in the condition of having lapped in connection with the motion of the RF electrode 15. Furthermore, up protection wall 71a is hung on chamber 7a, and in case chamber 7a is moved up and down, it moves up and down in connection with the motion. Moreover, opening is prepared in the part corresponding to insertion opening of the 2nd reactant gas installation tubing 9 of chamber 7a, an exhaust port 11, and wafer carrying-in / taking-out opening 17 at protection wall 7b.

[0039] The resultant with which this protection wall 7b was generated by the reaction of reactant gas prevents adhering to the wall of chamber 7a. That is, a resultant will adhere to the wall of protection wall 7b. When washing the above-mentioned protection wall 7b, after returning the inside of the membrane formation room 7 to an atmospheric pressure and removing the 2nd reactant gas installation tubing 9, as shown in drawing 5 , chamber 7a is moved to the upper part by the chamber lift 18, and up protection wall 71a and lower protection wall 71b are taken out. Up protection wall 71a and lower protection wall 71b which were taken out wash, and remove the resultant adhering to the wall of up protection wall 71a and lower protection wall 71b.

[0040] By setting taken-out another protection wall instead of protection wall 7b, membrane formation can be further continued within a CVD system. By this, a CVD system cannot be stopped over a long time for defecation of the membrane formation room 7 interior, and a throughput can be maintained, and the time and effort and cost for maintenance can be reduced. In addition, it is also possible to perform in-situ cleaning which introduces etching gas in the membrane formation room 7, and etches and removes a resultant by the case, without taking out the protection walls 71a and 71b. Therefore, it can prevent that chamber 7a hurts by etching. Moreover, it is also possible by forming a heating means in the perimeter of chamber 7a, and heating the protection walls 71a and 71b during etching to promote etching more and to raise the effectiveness of in-situ cleaning.

[0041] Moreover, in order to raise the bond strength of the resultant to the protection walls 71a and 71b so that the resultant which adhered to the front face of the protection walls 71a and 71b before exchange may not separate, irregularity may be formed in the front face of the protection walls 71a and 71b, and the touch area of a resultant may be enlarged. furthermore, the ** which is not accompanied by vertical migration of the RF electrode 15 when it seems that it is not necessary to move the wafer holder 12 up and down although what was divided into up protection wall 71a and lower protection wall 71b as protection wall 7b is used in the example -- wafer holder 12 independent one -- the upper and lower sides -- when movable, as shown in drawing 6 , what was formed in one as protection wall 7b may be used.

[0042] (D) The explanatory view 4 about the detail of the chamber lift concerning the example of this invention is a side elevation showing the detail of the chamber lift concerning the example of this invention. In drawing 4 , 31 is the ball screw (support shaft) which supports flange 11a of an exhaust port 11 through bearing support 32, and the gear tooth which goes around a shaft around spirally is formed in the ball screw 31. Moreover, 33 is the ball nut (support base) attached in seal section 7c of chamber 7a, is blown with the gear tooth of a ball screw 31 by the gear tooth which was formed in the wall of the hole in which a ball screw 31 is inserted and which goes around spirally, and supports a ball screw 31. A ball screw 31 fluctuates by rotating a ball screw 31.

[0043] 34 is a stepping motor (driving means) of five phases connected to a ball screw 31 through the helical coupling 35. Two helical gears bite and are put together, and the helical coupling 35 tells the turning effort of a stepping motor 34 to a ball screw 31. A ball screw 31 is rotated with a stepping motor 34, and vertical migration of the chamber 7a of the membrane formation room 7 is carried out through flange 11a of an exhaust port 11.

[0044] In order to exchange protection wall 7b especially, it uses, when opening and closing heavy chamber 7a. In addition, in the above-mentioned example, although this invention is applied to the CVD

system, this invention is applicable also to an etching system. Moreover, although the wafer holder 12 is laid on the RF electrode 15 for carrying out bias of the wafer 20, it may be prepared on one RF electrode among RF electrodes with which it counters for activating reactant gas.
(2) Explain briefly, referring to drawing 1 about the explanation about the membrane formation approach using the CVD system concerning the example of this invention, next actuation of the above-mentioned CVD system.
[0045] First, after laying a wafer (substrate) 20 in the wafer holder 12 and fixing electrostatic by the electrostatic chuck, the inside of the membrane formation room 7 is decompressed. Furthermore, as occasion demands, power is impressed to the heater coil 23 built in the wafer holder 12, a wafer 20 is heated, and it holds in temperature of about 200-500 degrees C. Moreover, the power of the frequency of 13.56MHz or 100 kHz is supplied to the RF electrode 15, and negative auto-bias direct current voltage is impressed to a wafer 20 through the wafer holder 12. This optimizes membraneous qualities, such as a consistency of the film formed, and stress.
[0046] Then, oxygen (O2) gas or O2+Ar mixed gas is introduced into the decompressed plasma production room 1. Moreover, power with a frequency of 13.56MHz is supplied to the external antenna 2 according to the RF power source 4 through a matching network 3. This emits a sink and an electromagnetic wave towards reverse for RF current which goes the plasma production room 1 around at two cyclic lead wire of the external antenna 2, respectively. Furthermore, a current is supplied to the inside source solenoid 5 and the outside source solenoid 6, and the magnetic field of shaft orientations is generated.
[0047] A helicon wave is excited by the above, the oxygen gas in the plasma production room 1 is activated, and the plasma of the high density (3 or more [1012cm -]) in the Helicon mode is generated. The generated plasma moves to the membrane formation room 7 of the lower stream of a river decompressed by the magnetic field, and activates SiH4 gas currently supplied on the wafer 20. SiH4 activated gas and the activated oxygen plasma react by this, and silicon oxide accumulates on a wafer 20.
[0048] According to the above-mentioned CVD system, the external antenna 2 to which the RF power-source 4 grade was connected is formed, and the plasma is generated by supplying RF power of frequency 13.56 MHz. Therefore, a facility of a waveguide required in the case of the ECR method etc. is unnecessary, and an equipment configuration becomes easy. Moreover, frequency of 2.45GHz in the case of the ECR method Since a low frequency can be used, generating of high-frequency power is easy.

[0049] Moreover, since the 1st reactant gas installation tubing 8 which introduces oxygen gas, and the 2nd reactant gas installation tubing 9 which introduces SiH4 gas are separated, the reaction of the reactant gas in the middle of supply is controlled, and generating of particle decreases. However, all gas may be introduced by the case from the 1st reactant gas installation tubing 8.
[0050]
[Effect of the Invention] As explained above, the electrode and heating means of an electrostatic chuck are formed in the common base in the substrate holder concerning this invention. Moreover, in membrane formation/etching system, it has this substrate holder. Therefore, it is only that the base of a substrate holder or the electrode of an electrostatic chuck intervenes between the substrates and heating means which were held, and for this reason, the power consumption for substrate heating can be cut down, and substrate temperature can be changed in a short time.
[0051] Moreover, the processing room has a chamber and dual structure of a protection wall, and it can dissociate with a chamber, and a protection wall can be removed, and can be renewed. Therefore, when a resultant adheres to the wall of a processing room, a chamber is removed, ejection and a protection wall are washed for a protection wall, and a resultant is removed from the wall. In this case, processing can be continued within a manufacturing installation during washing of a previous protection wall by setting another protection wall instead of the taken-out protection wall. By this, equipment cannot be stopped over a long time for defecation of the processing indoor section, and a throughput can be maintained, and the time and effort and cost for maintenance can be reduced.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the side elevation showing the configuration of the whole CVD system using the plasma in the Helicon mode concerning the example of this invention.
[Drawing 2] It is the perspective view showing the detailed configuration of the external antenna in the CVD system using the plasma in the Helicon mode concerning the example of this invention.
[Drawing 3] It is the sectional view showing the detail of the wafer holder concerning the example of this invention.
[Drawing 4] It is the side elevation showing the detailed configuration of the vertical migration device section of the chamber lift concerning the example of this invention, and a wafer holder.
[Drawing 5] It is the side elevation showing how to remove the protection wall concerning the example of this invention.
[Drawing 6] It is the side elevation showing the protection wall concerning other examples of this invention.
[Description of Notations]
1 Plasma Production Room,
2 External Antenna,
3 13 Matching network,
4 14 RF power source,
5 Inside Source Solenoid,
6 Outside Source Solenoid,
7 Membrane Formation Room (Processing Room),
7a Chamber,
7b Protection wall,
7c, 15a Seal section,
8 1st Reactant Gas Installation Tubing,
9 2nd Reactant Gas Installation Tubing,
9a Gas-evolution section,
10 Chamber Solenoid,
11 Exhaust Port,
11a Flange,
12 Wafer Holder (Substrate Holder),
12a Vertical migration device section,
15 RF Electrode,
16 Wafer Lift Pin,
17 Wafer Carrying-in / Taking-Out Opening,
18 Chamber Lift (Vertical Migration Means),
20 Wafer (Substrate),
21 Base,

22, 22a, 22b Electrode,
23 Heater Coil (Heating Means),
24, 24a, 24b, 26a, 26b, 27a, 27b Beer hall,
25, 25a, 25b, 27a, 27b Lead,
31 41 Ball screw (support shaft),
32 42 Bearing support,
33 43 Ball nut (support base),
34 44 Stepping motor (driving means),
35 45 Helical coupling,
50 Floor,
71a Up protection wall,
71b Lower protection wall,
72 Bellows.

[Translation done.]

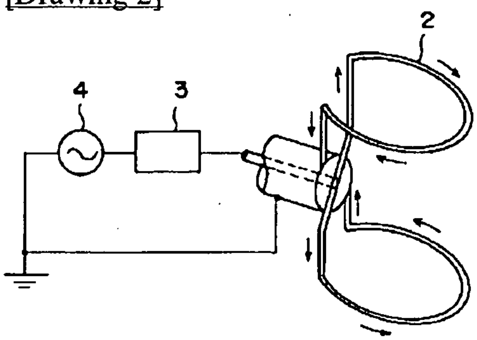
* NOTICES *

JPO and INPIT are not responsible for any damages caused by the use of this translation.

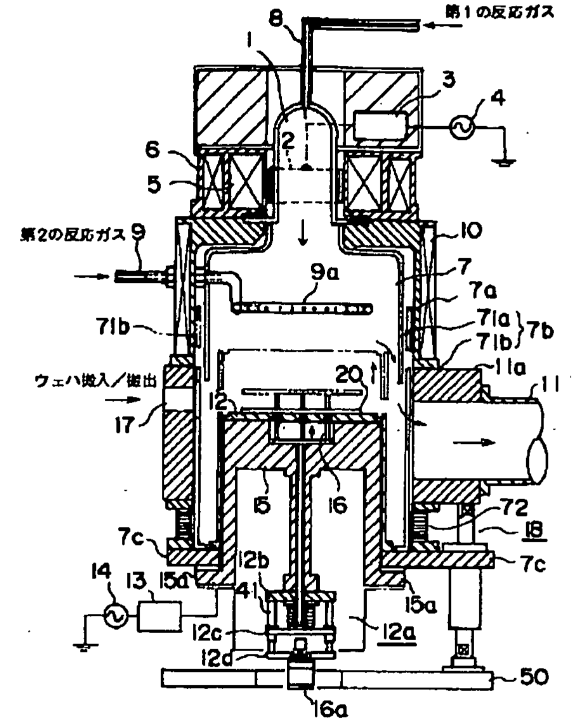
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 2]

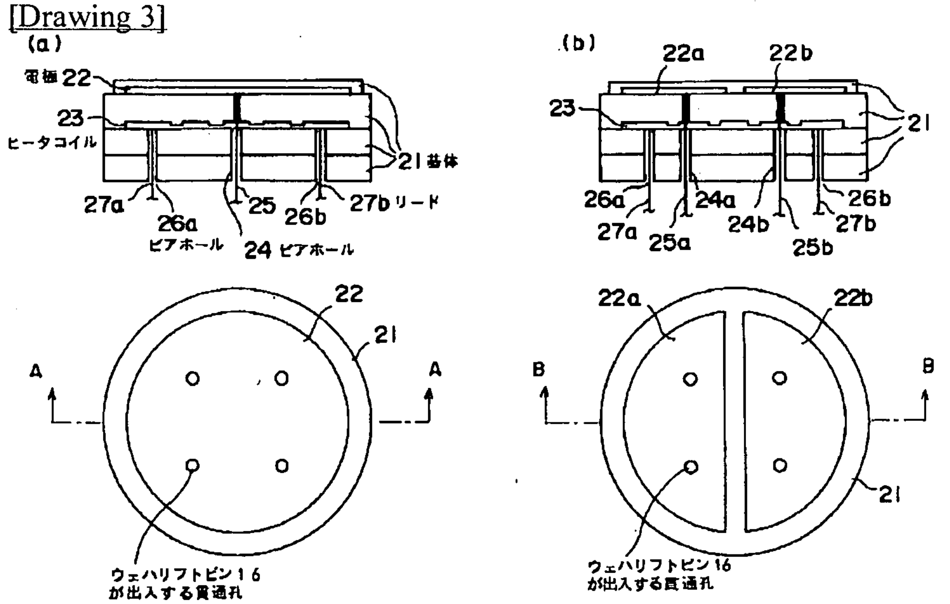


[Drawing 1]

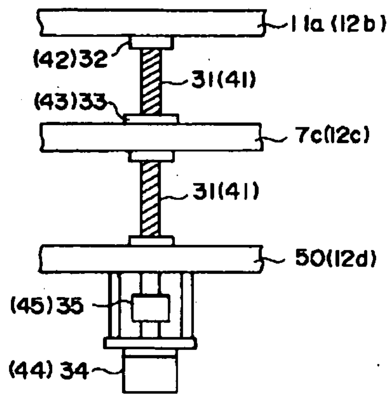


1：プラズマ生成室
2：外部アンテナ
3,13：マッチングネットワーク
4,14：RF電源
5：内側ソースソレノイド
6：外側ソースソレノイド
7：成膜室（処理室）
7a：チャンバ
7b：保護壁
7c，15a：シール部
8：第1の反応ガス導入管
9：第2の反応ガス導入管
10：チャンバソレノイド
11：排気口
11a：フランジ
12：ウェハ保持具（基板保持具）
12a：上下移動機構部
15：RF電極
16：ウェハリフトピン
17：ウェハ搬入／搬出口
18：チャンバリフト（上下移動手段）
20：ウェハ（基板）
71a：上部保護壁
71b：下部保護壁
72：ベローズ

[Drawing 3]

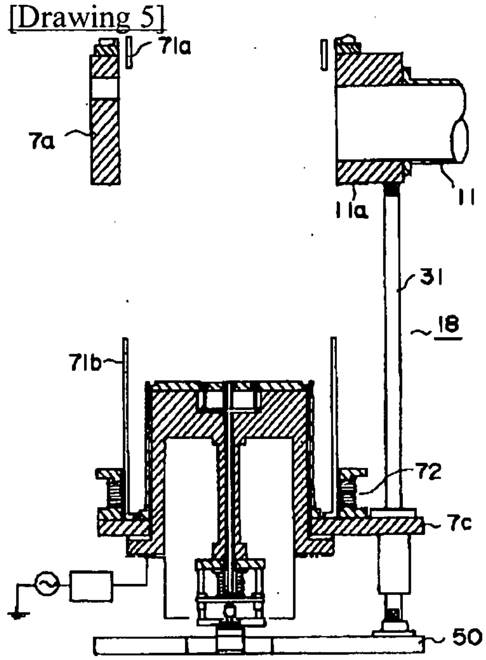


[Drawing 4]

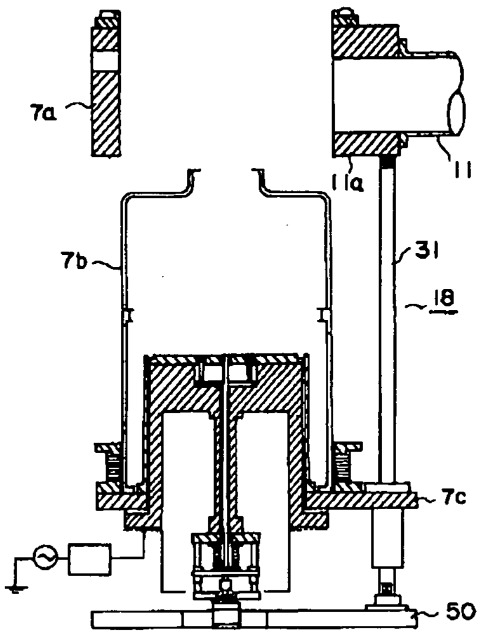


31,41：ボールネジ（支持軸）
32,42：ベアリングサポート
33,43：ボールナット（支持基体）
34,44：ステッピングモータ（駆動手段）
35,45：ヘリカルカップリング

[Drawing 5]



[Drawing 6]



[Translation done.]